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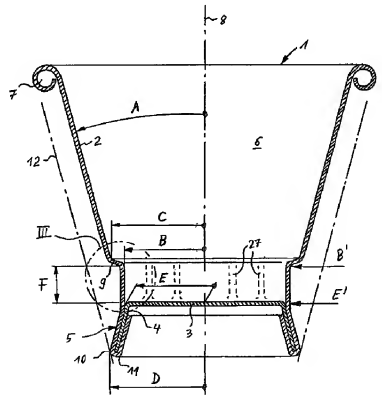
(54) Titre : GOBELET EN MATERIAU A BASE DE PAPIER, ET PROCEDE ET DISPOSITIF
(54) Title: CUP OF A PAPER MATERIAL, AND METHOD AND DEVICE FOR ITS MANUFACTURE

Fig. 1



(57) Abrégé/Abstract:
A beaker (1) made of paper material and a method and device for the production of a beaker (1) are described. The beaker (1) comprises a fillable inner space (6) formed by a conical casing (2) and a bottom (3). The bottom (3) is attached in a substantially

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(57) Abrégé(suite)/Abstract(continued):
liquid-tight manner at the lower end of the inner space (6) by a notch (5) on the casing (2). When several beakers (1) are stacked, a shoulder (9) for holding a similar beaker (1) is arranged on the casing (2) delimiting the inner space (6). Viewed from the center axis of the beaker (1), the radius (B) of the casing (2) under the shoulder (9) is at most the same size as the radius (E) of the casing (2) at the level of the bottom (3). The beaker (1) can have a heat-insulating outer casing (13).

Abstract

A cup made of a paper material, and a method and a device for manufacture of a cup, are described. The cup contains a fillable interior formed by a conical sleeve and a bottom. The bottom is fastened to the sleeve at the lower end of the interior with a skirt in a substantially liquid-tight manner. A shoulder for holding an identical cup during stacking of several cups is arranged on the sleeve limiting the interior. The radius of the sleeve, seen towards the central axis of the cup, underneath the shoulder is at most just as large as the radius of the sleeve at the level of the bottom. The cup can have a thermally insulating outer sleeve.

Cup of a paper material, and method and device for its manufacture

The invention relates to a cup made of a paper material having a fillable interior formed by a conical sleeve and a bottom, the bottom being fastened to the sleeve at the lower end of the interior with a skirt in a substantially liquid-tight manner, where a shoulder for holding an identical cup during stacking of several cups is arranged on the sleeve limiting the interior.

The invention further relates to a method for manufacture of a cup made of a paper material comprising a conical sleeve and a bottom fastened in a liquid-tight manner by a skirt in the area of the smaller circumference of the sleeve, where a shoulder is shaped into the sleeve for holding an identical cup during stacking of several cups.

The invention also relates to a device for manufacture of a cup made of a paper material with a receiving mandrel for a conical sleeve and a bottom of the cup, the receiving mandrel having a step for forming a shoulder in the sleeve.

The term "shoulder" should be understood as meaning that the shoulder forms an abrupt size change of the sleeve. Seen from the bottom of the cup to a filling opening, the shoulder represents an abrupt cross-section widening. The shoulder can also be described as a "bead". The shoulder or bead is a means for holding another cup of the same type. For transport, a large number of identical cups are stacked one inside the other. The shoulder is provided in the sleeve as a means for stacking so that the cups do not stick inside one another and can be easily destacked again.

A cup, a method and a device of the type mentioned at the outset is prior art from DE 10 2004 056 932 A1. The known cup has a shoulder giving the cup fairly good stacking

properties. During manufacture of the known cup, a prefabricated cup is used as the semi-finished product, in which the bottom is already fastened in liquid-tight manner to the sleeve by the skirt. The shoulder is formed by an axial displacement of a shaping tool in the direction of the greater circumference of the conical sleeve. The inner diameter of the shaping tool is greater than the outer diameter of the bottom and the skirt, so that the shaping tool can be slid over the skirt from underneath without damaging the skirt and impairing its tightness. The result is inevitably that the radius of the sleeve underneath the shoulder is greater than at the level of the bottom. The magnitude of the abrupt size change of the sleeve at the shoulder is thus restricted.

The object underlying the invention is to improve the stacking properties of a cup of the type mentioned at the outset.

The object is achieved in the cup in that the radius of the sleeve – seen towards the central axis of the cup – underneath the shoulder is at most just as large as the radius of the bottom. The radius of the sleeve underneath the shoulder is preferably even smaller than at the level of the bottom.

In the case of the method, the object is achieved in that to shape the shoulder an area of the sleeve is shaped to give a radius – seen towards the central axis of the cup – that is smaller than the radius of the sleeve in the completed cup at the level of the bottom. The shoulder is preferably shaped before the bottom is connected substantially in liquid-tight manner to the sleeve. In the case of the device, the object is achieved in that an area in which the radius of the receiving mandrel is – seen with respect to the central axis of the cup – smaller than the outer radius of the cup bottom is adjacent to the step of the receiving mandrel.

The stacking properties of a cup of this type are improved since the abrupt size change of the sleeve is increased at the shoulder. The stability and force absorption capacity of the shoulder is increased, so that even a large number of stacked cups do not stick to one another and can be destacked again without any problem.

It is immaterial which form the sleeve of the cup has in cross-section. The sleeve is preferably circular in cross-section, but can alternatively also be oval or rectangular with rounded corners. The cup has, in the case of a round cross-section, an approximately frustum-like shape, whereas in the case of a rectangular cross-section of the sleeve it has a more truncated pyramid-like shape. The radius of the sleeve is, in the case of a non-round cross-section of the sleeve, defined as the distance of an area of the sleeve from the central axis of the cup. In the case of a circular cross-section of the sleeve, the radius is defined as half of the diameter.

The term "paper material" of which the bottom and the sleeve consist can be understood as different materials having at least one layer of paper, paperboard or cardboard. In addition, the material can have one or more layers of plastic or aluminium. It can also be provided that the paper material is waxed or lacquered to ensure a resistance to the liquid to be poured into the interior. The paper material is preferably coated at least on the side limiting the interior with a thin plastic layer, preferably of polyethylene. Unlike a pure plastic material, the shapeability and in particular the stretchability of such paper material is restricted. If deformed too much, the paper material itself or a coating provided on it can tear, so that tightness is impaired.

In cups made of paper material, therefore, the skirt is an essential and indispensable design feature. The skirt is necessary for the connection between the sleeve and the bottom. At least two material layers are in contact with one another at the skirt in the thickness direction, these being the material of the bottom and the material of the sleeve limiting the interior. The bottom is preferably of bowl-like design, with its open side facing away from the filling opening of the cup. The at least two material layers are therefore preferably arranged along the wall of the bowl-like bottom. It can be additionally provided that for example the sleeve is wrapped around the material of the bottom and that the skirt comprises three or more material layers. The material of the bottom is glued or sealed to the material of the sleeve in the area of the skirt in order to be liquid-tight at least for a certain period.

It is advantageous that during the manufacture of the cup the shoulder is shaped before the bottom is connected in substantially liquid-tight manner to the sleeve. The bottom is, during shaping of the shoulder, preferably already inside the sleeve shaped into a tube, but is not yet connected to the sleeve. The radius of the bottom can thus be reduced in the elastic area by compression during shaping of the shoulder. This has the advantage that the skirt does not hinder shaping of the shoulder, and as a result a shoulder can be manufactured with a larger abrupt size change. The tightness of the skirt cannot be impaired by the shaping of the shoulder, since the bottom is first connected in substantially liquid-tight manner to the sleeve in a method step subsequent to the shaping of the shoulder. Surprisingly, the compression of the bottom does not impair the subsequent manufacture of the skirt at all.

In an advantageous embodiment of the invention, the shoulder is shaped by an axial movement of a shaping tool in the direction of the larger circumference of the conical sleeve. The shaping tool is slid over the sleeve from underneath, i.e. from the area with a smaller circumference of the conical sleeve. The material of the sleeve is compressed. During this compression, there is a material compaction in the area of the shoulder that increases the stability of the shoulder. A vertical portion of the receiving mandrel arranged inside the conical sleeve preferably has a constant radius that supports the sleeve from the inside during shaping of the shoulder. The sleeve is shaped during shaping of the shoulder to a constant radius in one vertical portion. As a result, it is possible to obtain a vertical portion of the sleeve preferably below the shoulder in which the sleeve is substantially parallel to the central axis of the cup. The forces acting parallel to the central axis when several cups are stacked can thus be easily absorbed and dissipated by the shoulder.

The sleeve does not run exactly parallel to the central axis in an area underneath the shoulder, in particular when the radius of the sleeve underneath the shoulder is smaller than at the level of the bottom. Depending on the size difference of the radii and on the properties of the paper material used, in particular its stiffness, different angles of the sleeve result in a vertical portion underneath the shoulder. The radius of the sleeve underneath the shoulder is preferably 0.05 mm to 0.5 mm, in particular about 0.1 to 0.3

mm, smaller than the radius of the sleeve at the level of the bottom. As a result, a very stable shoulder can be obtained in which no cracks yet occur in the paper material. Underneath the shoulder, a vertical portion of the sleeve then exists in which the angle of the sleeve is negative, i.e. less than zero. This assumes a definition of the angle of the sleeve relative to the central axis of the cup in which a positive cone angle applies when the circumference of the sleeve lessens from the filling opening in the direction of the bottom. An area of the sleeve running parallel to the central axis has a cone angle of 0°, and an area of the cup widening towards the bottom has a negative cone angle.

With this definition of the cone angle, the shoulder can also be defined such that underneath the shoulder a vertical portion of the sleeve exists in which the angle of the sleeve relative to the central axis is substantially smaller than the angle of the conical sleeve above the shoulder. This condition is also achieved by a negative cone angle, even if its amount is greater than the cone angle above the shoulder. The angle of the sleeve underneath the shoulder is preferably less than half of the angle above the shoulder. As a result, a shoulder with a considerable and abrupt size change can be achieved that has good stacking properties. In an embodiment of the invention, it is advantageous that the vertical portion of the sleeve underneath the shoulder, in which the angle of the sleeve differs from the cone angle above the shoulder, extends from the shoulder to the bottom. The distance from the shoulder to the bottom is preferably less than 10 mm. The forces occurring during stacking can therefore be absorbed very readily by the skirt.

For a further stability improvement of the sleeve in the area underneath the shoulder, it can be provided that underneath the shoulder a vertical portion of the sleeve exists in which ribs running parallel to the central axis are arranged. The ribs can be shaped during forming of the shoulder in the sleeve. To do so, it is advantageous that the shaping tool has recesses running parallel to the central axis for forming of the shoulder. Since the material is compressed underneath the shoulder, the recesses in the shaping tool can receive part of the excess material so that there is no uncontrolled creasing during shaping of the shoulder.

To obtain a stable shoulder, it is advantageous for the radius of the sleeve underneath the shoulder to be more than 0.5 mm, in particular even more than 1 mm, smaller than the radius of the sleeve above the shoulder. The radius of the receiving mandrel changes by more than 0.5 mm, in particular by more than 1 mm, preferably at the step for shaping the shoulder. The radius of the receiving mandrel preferably changes at the step by about 1 mm to 1.5 mm. It is advantageous that the step has an angle from 40° to 70°, in particular from 50° to 60°, relative to the central axis of the receiving mandrel, in order to shape a shoulder with high stability.

In a further embodiment of the invention, it is advantageous to curl the sleeve around an area of the bottom in a single method step together with shaping of the shoulder.

The shaping tool for shaping the shoulder here has a means for shaping the curl of the sleeve enclosing the bottom. During axial sliding of the shaping tool onto the sleeve, therefore, the lower edge of the sleeve is curled inwards simultaneously with shaping of the shoulder, and wrapped around the wall of the bottom. The manufacture of the cup in accordance with the invention is considerably facilitated as a result. The shaping tool is preferably designed as a ring.

The stacking of an identical cup on the shoulder can be done in different ways. It is advantageous that a lower rim of the skirt forming the standing surface for the cup rests during stacking on the shoulder of an identical cup. It is provided in a particularly advantageous way that the sleeve and/or bottom in the area of the skirt and/or the skirt itself has at least in an area along the circumference an outward-projecting widened portion and that a lower rim of the widened portion forms a standing surface for the cup. The outer radius of the widened portion is preferably greater than the outer radius of the sleeve at the level of the bottom. The standing surface of the cup is increased by the widened portion so that the cup has an improved stability. The stacking properties of the cup are also improved since the skirt is a very sturdy element of the cup and is very well suited to absorb the forces occurring during stacking. The widened portion is, in a preferred embodiment, shaped continuously and evenly along the circumference. The manufacture of the cup is greatly simplified if during formation of the skirt the sleeve

and/or the bottom in the area of the skirt and/or the skirt itself is widened outwards at least in an area along the circumference such that a lower rim of the widened portion forms a standing surface for the cup. To manufacture the widened portion, no additional method steps are then necessary. The widened portion is, just like the shoulder, a means for holding another cup of the same type. The dimensions of the shoulder and of the widened portion are adapted to one another to ensure optimum stacking.

It can be provided in an embodiment of the invention that the cup has a thermally insulating outer sleeve. The design of the thermally insulating outer sleeve can be of any type. The outer sleeve can for example be made from a plastic, paper or laminated material. To improve the insulation effect, the outer sleeve can also be corrugated, grooved, embossed or provided with a foamed-on coating. For example, a corrugated intermediate layer can be provided that is covered by an outer layer laid flat over it.

Depending on the design of the outer sleeve, it may be advantageous to attach to the outer sleeve a means for holding another cup of the same type that rests on the shoulder during stacking. This embodiment has the advantage that no second means needs to be provided for stacking on the inner cup. The widened portion on the skirt can be dispensed with in this case.

It is however particularly advantageous when the cup can be securely and stably stacked even without the presence of an outer sleeve. An optionally provided outer sleeve can as a result be designed largely independently and freely. The outer sleeve is not stressed by the forces occurring during stacking, so that no particular stability requirements are placed on the outer sleeve. One and the same inner cup can be combined in a simple and almost any way with a wide variety of outer sleeves. Without changing the form and dimensions of the inner cup or of the components forming the fillable interior, various cups with different visual and haptic appearance can be created, since the appearance perceived by the user of the cup is determined mainly by the design of the outer sleeve. This creative freedom in design can be supported in that the outer contour of the outer sleeve is within a parallel to the sleeve limiting the interior that is applied to the widened portion of the skirt. It is advantageous for ease of manufacture that – after shaping of a widened skirt – an

outer sleeve pre-shaped in a tube form is slid in the axial direction onto the conical sleeve of the inner cup limiting the interior. To manufacture the outer sleeve, the latter is initially wound onto a mandrel using a blank having the shape of a segment from a circular ring and connected to form a frustum-like tube. In the area of the lower circumference of the outer sleeve, an inward-facing curl is shaped. The inward-facing curl has an area running substantially parallel to the outer sleeve. The curl at the lower rim of the outer sleeve can be pressed flat. Additionally, the lower rim can be slightly drawn in so that a greater conicity is achieved at the lower end of the outer sleeve. The inward-facing curl at the lower end of the outer sleeve is used to support the outer sleeve on the inner cup. The curl preferably rests on the skirt underneath the bottom. To achieve a good contact of the curl with the inner cup, it is advantageous that the outer sleeve has in the area of the curl an inner radius smaller than the outer radius of the skirt at the lower rim of the widened portion.

Further advantages and features of the invention can be found in the claims and the following description of embodiments of the invention in conjunction with the figures. Individual features of the various embodiments shown and described can be combined with one another as required without going beyond the scope of the invention.

The drawings show in:

Figure 1	a cup in accordance with the invention in a longitudinal section,
Figure 2	a view similar to Figure 1 onto two stacked cups,
Figures 3a to 3b	various embodiments of the area III of the cup in Figure 1 in an enlarged view,
Figures 4 and 5	views similar to Figure 1 onto partially shown cups of different design, in which different outer sleeves are provided,

Figure 5a	an enlarged view of a partial area of a variation of the cup in accordance with Figure 5,
Figure 6	a partially shown longitudinal section through a device for manufacture of a shoulder on the sleeve of the cup in Figure 1,
Figures 7A and 7B	views in the direction of the arrow VII of Figure 6 onto receiving mandrels of differing design,
Figure 8	a view in the direction of the arrow VIII of Figure 6 of a shaping tool for shaping a shoulder,
Figure 9	a view of a variant of Figure 6,
Figure 10	a partially shown longitudinal section through a device for compressing the skirt,
Figures 11 and 12	a partially shown outer sleeve of the cup in Figure 5 in a longitudinal section during different manufacturing steps.

The cup 1 shown in Figure 1 substantially comprises a conical sleeve 2 and a bowl-like bottom 3. The open side of the bowl-like bottom 3 is arranged such that it is facing away from the filling opening of the cup 1. The bottom 3 with its wall 4 is connected in the area of the smaller circumference of the sleeve in a liquid-tight manner to said sleeve, forming a skirt 5. In the area of the skirt 5 the material of the sleeve 2 is wrapped around the wall 4 of the bottom 3 and folded inwards. The sleeve 2 and the bottom 3 form a fillable interior 6 of the cup 1. The sleeve 2 has on its upper rim, i.e. in the area of the larger circumference, an outward-formed top curl 7 surrounding the filling opening.

The property "conical" of the sleeve must be understood here as meaning that the sleeve 2 tapers at least in some sections from the top curl 7 to the bottom 3 in the longitudinal section shown in Figure 1, i.e. is reduced at least in some sections in its radius to the central axis 8. In the lower area of the fillable interior 6, preferably in the lower third, the

sleeve 2 has a shoulder or bead 9. The sleeve 2 has an angle A relative to the central axis 8. The sleeve 2 can have different inclination angles A in different areas. The angle A is constant over a large area of the interior 6. The angle A is defined such that the angle A of the sleeve 2 has a positive value between the top curl 7 and the shoulder 9 in Figure 1. An inclination angle A of 0° corresponds to a sleeve 2 running parallel to the central axis 8. If the sleeve 2 widens in the direction of the standing surface of the cup, as is the case in the area of the skirt 5, the inclination angle A is negative.

The skirt 5 has at least in an area along its circumference an outward-protruding widened portion 10. A lower rim 11 of the widened portion 10 on the skirt 5 forms the standing surface for the cup 1. The standing surface is enlarged by the widened portion 10 such that tipping over of the cup is made more difficult.

The shoulder 9 is formed by a practically abrupt size change of the sleeve 2. The radius B of the sleeve 2 underneath the shoulder 9 – seen towards the central axis 8 – is about 1 mm to 1.5 mm smaller than the radius C of the sleeve 2 above the shoulder 9. The cup 1 preferably has a circular cross-section. In this case, the radius of the sleeve corresponds to half the diameter. In the area of the shoulder 9, the sleeve 2 has a very large inclination angle A that is approximately 40° to 70°, and preferably 50° to 60°. The shoulder 9 serves to hold an identical cup 1' during stacking of several cups 1 and 1', as shown in Figure 2. The cup 1' stacked inside the cup 1 rests with its skirt 5' on the shoulder 9 of the cup 1. The radius D of the widened portion 10 is here adapted to the radius C above the shoulder 9. This ensures that the cup 1' rests stably and securely on the shoulder 9 without however sticking inside the conical sleeve 2. The forces occurring during stacking along the central axis 8, for example the weight forces of the cup 1' and of any cups possibly stacked above it, are reliably absorbed by the shoulder 9 and passed on via the sleeve 2 to the bottom edge 11 of the skirt 5 of the lower cup 1 and from there transmitted to the ground. Thanks to the design in accordance with the invention of the shoulder 9, even very high forces in the direction of the central axis 8 can be absorbed and easy removability of the cup 1 or 1' during destacking is assured.

In a cup 1 in accordance with the invention, the shoulder 9 is designed such that the radius B of the sleeve 2 underneath the shoulder is at most the same size as the radius E of the sleeve 2 at the level of the bottom 3. Of course the radius B' and E' measured at the outside of the sleeve 2 could also be compared with one another. Below the shoulder 9, a vertical portion F of the sleeve 2 is provided in which the angle A of the sleeve 2 differs from the angle A of the conical sleeve above the shoulder 9. The vertical portion F extends from the shoulder 9 to the bottom 3. To achieve a good stability of the vertical portion F, it has proved advantageous to design the vertical portion F not larger than 10 mm.

In the vertical portion F, the sleeve 2 runs substantially parallel to the central axis 8. This is advantageous to achieve a good transmission of the forces occurring during stacking from the shoulder 9 to the skirt 5. The Figures 3A to 3D show in enlarged form differing and advantageous variants for the design of the vertical portion F underneath the shoulder 9. In Figure 3A, the sleeve 2 runs exactly parallel to the central axis 8 in the vertical portion F. The radius C of the sleeve underneath the shoulder is thus exactly the same size as the radius E of the sleeve at the level of the bottom 3. In Figures 3B, 3C and 3D, the radius B underneath the shoulder 9 is smaller than the radius E at the level of the bottom 3. The radius B is preferably about 0.15 to 0.2 mm smaller than the radius E. The fact that the radius B is a few tenths of a millimeter smaller than the radius E allows an increase in the width of the shoulder 9 when the radius C is constant above the shoulder 9. The widening of the shoulder 9 allows a significant increase in stability of the shoulder 9 to be achieved when several cups 1, 1' are stacked.

In the embodiment shown in Figure 3B, the vertical portion F is divided into two areas. In the vertical portion F', the sleeve 2 is parallel to the central axis 8. In the vertical portion F'', the inclination angle A of the sleeve is negative, and here the sleeve 2 widens towards the bottom 3.

In the embodiment in accordance with Figure 3C, the angle A of the sleeve 2 is also negative in the vertical portion F''. In the vertical portion F' the angle A is positive, but substantially smaller than the angle A of the conical sleeve 2 above the shoulder 9. The

angle A in the vertical portion F' is preferably less than half of the angle A of the conical sleeve 2 above the shoulder 9.

Figure 3D shows an embodiment in which the sleeve 2 has a negative angle over the entire vertical portion F. The sleeve 2 thus has in the vertical portion F a reverse conicity compared with the sleeve above the shoulder 9.

Due to the definition of the cone angle A with positive and negative values, in all embodiments of Figures 3A to 3D the inclination angle A of the sleeve 2 in the vertical portion F underneath the shoulder 9 is substantially less than the angle A of the conical sleeve 2 above the shoulder 9.

Although it is not shown in Figures 1 to 3, it can be advantageous to assign to the cup 1 an outer sleeve that surrounds the sleeve 2 limiting the interior 6, preferably while forming a cavity. In order not to impair the stacking of the cup 1, it can be advantageous that the outer contour of the outer sleeve is inside a parallel 12 to the sleeve 2 limiting the interior 6, the parallel 12 being applied to the widened portion 10 of the skirt 5. As long as an outer sleeve is inside the space between the parallel 12 and the sleeve 2 limiting the interior 6, the stacking properties of the cup are not affected in any way. The creative freedom in design for the outer sleeve is thus almost not subjected to any limits. It is furthermore possible to provide a common version of the cup 1 with different outer sleeves without having to change the shoulder 9 and the widened portion 10 essential for stacking. Subsequently, some possible embodiments for such outer sleeves are described with the aid of Figures 4 and 5.

The cups 1 shown in Figures 4 and 5 each have a thermally insulating outer sleeve 13 surrounding the sleeve 2 limiting the interior 6, partly while forming a cavity 14. Such cups are also referred to as double-walled insulating cups, in which the sleeve 2 located inside the outer sleeve 13 in conjunction with the bottom 3 can also be referred to as an "inner cup". The inner cups, in particular with the shoulder 9, are each designed similarly to the variants described in Figures 1 to 3, so a repeated description can be dispensed with.

The outer sleeve 13 of the cup 1 shown in Figure 4 is substantially arranged parallel to the sleeve 2 limiting the interior 6. The outer sleeve 13 has at its upper end and lower end in each case an inward-facing curl 15 and 16 and rests with these curls 15 and 16 on the sleeve 2. It can be provided that the outer sleeve 13 is fixed, for example glued, in the area of the curl 15 and/or 16. The curl 16 rests, in the area of the skirt 5 and hence underneath the horizontal bottom 3, on the inner sleeve 2, thus making the outer sleeve 13 very stable. The inner radius P of the curl 16 is therefore smaller than the radius D of the widened portion 10. At the same time, the outer sleeve 13 also covers the shoulder 9, so that the latter cannot be discerned from the outside. The curl 16 has an area 17 running parallel to the outer sleeve 13. The area 17 runs close to the inside of the outer sleeve 13 and can also contact it. The radius G at the upper edge 35 of the area 17 running parallel to the outer sleeve 13 is larger than the radius D of the widened portion 10 at the skirt 5. As a result, sliding of the outer sleeve 13 onto the sleeve 2 is greatly simplified, since the curl 16 of the outer sleeve 13 can no longer catch on the skirt 5.

In Figure 5, the sleeve 2 has in the area underneath the top curl 7 a second shoulder 18 which, seen from the bottom 3 towards the top curl 7, is shown as an abrupt cross-section expansion. The outer sleeve 13 is, in the area between the top curl 7 and the shoulder 18, connected to the sleeve 2 limiting the interior 6, for example by sealing or glueing. At its lower end, the outer sleeve 13 has an inward-facing curl 16 that also has an area 17 running parallel to the outer sleeve 13. The curl 16 rests on the skirt 5 underneath the bottom 3. The curl 16 is, unlike in Figure 4, pressed flat and slightly drawn in at the lower rim area, so that a greater conicity of the outer sleeve 13 applies there. The radius P is smaller than the radius D, while the radius G is larger than the radius D.

An advantageous modification of the cup 1 in the area of the upper shoulder 18 is shown in greatly enlarged form in Figure 5A. The area of the sleeve 2 between the top curl 7 and the shoulder 18 has a different inclination angle from the sleeve 2 between the shoulder 18 and the shoulder 9. In Figure 5A, the sleeve 2 runs between the top curl 7 and the shoulder 18 approximately parallel to the central axis 8. In order that the outer sleeve 13 can be slid slightly under the top curl 7 during sliding onto the inner cup, the upper rim area 20 of the outer sleeve 13 is slightly drawn in. The rim area 20 therefore does not

continue the conical sleeve 13 evenly, but has a different angle to the central axis 8. If the outer sleeve 13 is, as shown in Figure 5A, slid with its upper rim area 20 slightly into the top curl 7, this results in a particularly good appearance of the cup 1, since the upper rim of the outer sleeve 13 is no longer visible. If the outer sleeve 13 is, in an embodiment not shown, slid even further into the top curl 7, the gripping of the outer sleeve 13 by the material of the top curl 7 already effects the fixing of the outer sleeve 13. For certain applications, the gripping of the outer sleeve 13 in the top curl 7 may be sufficient as the sole fastening of the outer sleeve 13.

During the manufacture of a cup 1 in accordance with Figure 1, first a conical sleeve 2 and an approximately bowl-like bottom 3 are shaped. As can be seen in the illustration in Figure 6, the sleeve 2 later forming the interior 6 initially has the shape of a conical tube. The bottom 3 has the form of a frustum tapering parallel to the tube 2. In the state shown in Figure 6, the bottom 3 and the sleeve are not yet connected to one another, but only inserted into one another. The sleeve 2 is here fitted onto a receiving mandrel 21 which has in a first vertical portion H a frustum-like shape in which the inclination angle of the circumference surface corresponds to the angle A of the sleeve 2 relative to the central axis 8. A step 22 for shaping of a shoulder 9 in the sleeve 2 adjoins the tapered end of the frustum-like portion H. The step 22 has a larger inclination angle A than the vertical portion H, the angle A of the step 22 being preferably 50° to 60° and selected to match the inclination angle of the shoulder 9 required at the cup 1. An area J, in which the radius K of the receiving mandrel 21 when seen relative to the central axis 8 of the receiving mandrel is smaller than the outer radius E of the cup bottom 3 and preferably remains constant over the height J, adjoins the step 22. The radius of the receiving mandrel 21 changes at the step by more than 1 mm, in particular by 1 mm to 1.5 mm. As a result, a shoulder 9 drawn relatively far into the interior 6 can be manufactured to ensure safe stacking of several cups, as already described above. The radius K is here some tenths of a millimeter smaller, in particular about 0.15 to 0.2 mm smaller, than the radius E. The size of the radius K in comparison with the radius C and radius E, and the stiffness of the paper material used for the sleeve 2, later determines the appearance of the shoulder 9 and of the vertical portion F underneath the shoulder on the completed cup 1, as shown in particular in Figure 3.

For shaping the shoulder 9, not only the receiving mandrel 21 is used but also a shaping tool 23, shown below in Figure 6 and movable along the central axis 8 of the receiving mandrel 21. The shaping tool 23 is moved in the direction of the arrow L onto the receiving mandrel 21. The shaping tool 23 has a surface 24 which substantially corresponds in its angle relative to the central axis 8 to the inclination angle A of the step 22. The shaping tool furthermore has a surface 25 of which the radius M is matched to the radius K of the receiving mandrel 21 and to the thickness of the paper material of the sleeve 2. The radius M can here even be smaller than the radius E of the bottom 3. The tube 2 is thus gripped between the receiving mandrel 21 and the shaping tool 23, so that the shoulder 9 is shaped between the surface 24 and the step 22. Since the bottom 3 and the sleeve 2 are not yet connected to one another by sealing or glueing, the sleeve 2 can be compressed more strongly to form the shoulder 9 than would be possible if the sleeve 2 and the bottom 3 were already connected. When sliding the shaping tool 23 in the direction of the arrow L, the radius E of the bottom 3, which is in fact already inside the sleeve 2, is reduced in the elastic area by compression. The bottom 3 thus reduces its radius E to the radius K of the receiving mandrel 21. The axial movement of the shaping tool 23 in the L direction to the larger circumference of the conical sleeve 2 results in a compaction of the paper material of the sleeve 2 in the area between the surface 24 and the step 22. This allows a very stable shoulder 9 to be made on the completed cup 1.

Figures 7A and 7B show plan views onto two different variants of the receiving mandrel 21. The receiving mandrel 21 shown in Figure 7A is used for shaping a shoulder 9 running along the entire circumference of the sleeve 2. The step 22 is therefore designed as a circumferential surface of a frustum. A cylindrical area J having the radius K adjoins the step 22. The surface 24 of the shaping tool 23 interacting with the step 22 during shaping of the shoulder 9 is in this case also designed as a frustum surface. The surface 25 of the shaping tool enclosing the area J underneath the step 22 is designed as a cylindrical surface, as can be seen in the view in Figure 8. An embodiment of this type for the device to manufacture the cup 1 with a shoulder 9 running round the entire circumference is simply constructed and permits the manufacture of a very stable shoulder 9.

Figure 7B shows an alternative embodiment of a receiving mandrel 21' with which three separate shoulders can be shaped along the cup circumference. A design like this can also be advantageous for special applications, since the stress on the paper material of the sleeve 2 during the formation of separate shoulders is more advantageous depending on the paper material used. In the receiving mandrel 21', three steps 22' are evenly distributed over the circumference. In the area of each step 22', a vertical portion J is provided having a radius K relative to the central axis 8 and used for shaping one shoulder. The statements already made relating to Figure 6 apply accordingly for a design form in accordance with Figure 7B. The shaping tool associated with the receiving mandrel 21' is not shown. The shaping tool 23 shown in Figure 6 must be adapted in the area of the surfaces 24 and 25 to the design of the steps 22' of the receiving mandrel 21'.

As already mentioned, the paper material of the sleeve 2 is compressed to a smaller radius during sliding of the shaping tool 23 in the area J. Depending on the paper material and depending on the size change between the radius C and the radius K, it can be advantageous to provide in the shaping tool 23 recesses 26 running parallel to the central axis 8 for shaping ribs 27 which can absorb material. The recesses 26 are indicated by dashed lines in the Figures 6 and 8. The ribs 27 shaped by the recesses 26 are indicated by dashed lines on the completed cup 1 in Figure 1. The ribs 27 achieve additional stiffening of the vertical portion F underneath the shoulder 9 and can further improve the stacking properties of the cup 1.

So that the sleeve 2 can be connected to the bottom 3 while forming the skirt 5, the lower end 28 of the sleeve 2 is folded over so that it has the position 30 shown in dashed lines by Figure 6. The shaping tool 23 has a means 29 for shaping a curl 30 of the sleeve 2 that encloses the bottom 3. The means 29 for curling the sleeve 2 is designed as a channel-like area which is only shown in some sections in the sectional view of the shaping tool 23 in Figure 6, but extends over 360°. The simultaneous folding over of the lower rim 28 of the sleeve 2 with the shaping of the shoulder 9 considerably facilitates the manufacture of the cup in accordance with the invention.

The sleeve 2 is wound over a mandrel using a segment of a circular ring and then glued or sealed along a longitudinal seam. To facilitate folding of the lower rim 28 of the sleeve 2 by means of the shaping tool 23, the longitudinal seam of the sleeve 2 can remain unglued or unsealed in the area of the lower end 28. This area is identified as N in the illustration in Figure 6. If the longitudinal seam in the area N is not glued or sealed, the sleeve 2 can be shaped more freely when the lower end 28 is folded, and a waviness of the paper material, which in principle is difficult to shape, is avoided. The area N can extend from the lower rim 28 of the sleeve even up to the lower edge of the bottom 3, as indicated in Figure 6 with the reference character N'. The length of the area N or N' is thus variable and can be changed appropriately to cater for requirements.

Following the shaping of the shoulder 9 and the folding over of the lower end 28 of the sleeve 2, in a subsequent method step to complete the inner cup 1 the bottom 3 is connected to the sleeve 2, while forming a skirt 5, in a substantially liquid-tight manner. This is achieved with the aid of an outer ring and an inner tool, where during connection of the bottom 3 to the sleeve 2 the skirt 5 is widened at the same time, so that the shape of the skirt 5 shown in Figure 1 and widening towards the lower rim 11 is obtained. This is explained further using Figure 10. Figure 9 shows a further embodiment of the invention, where unlike in the embodiment in Figure 6 the sleeve 2 has an initially conical form that then merges into a cylindrical form at the horizontal bottom 3'. Logically, the bottom 3' in this embodiment has an inverted bowl shape with cylindrical all-round wall 4'. The designs of both the receiving mandrel 21 and the shaping tool 23 are however identical for the already explained shaping process in accordance with Figure 6. Thanks to the cylindrical pre-shaping of the all-round wall 4' of the bottom 3', and the likewise cylindrical pre-shaping of the lower area of the sleeve 2', crease formation when folding the lower rim 28' round the sleeve 2' and during subsequent widening and formation of the skirt 5 is reduced.

The method step for formation of the skirt 5 subsequent to shaping of the shoulder 9 is described with the aid of Figure 10. The starting state is the curl 30', shown by dashed lines in Figure 9, which results after folding over of the lower end 28' of the sleeve 2'. Figure 10 shows that the angle A of shoulder 9 substantially corresponds to the inclination

angle of step 22. Depending on the stiffness and elasticity of the paper material used for the sleeve 2, it may be that the radius B underneath the shoulder 9 slightly increases again in comparison with the radius K of the receiving mandrel 21 during withdrawal of the shaping tool 23. During shaping of the shoulder 9, the sleeve 2 is pressed together so far by the surface 25 of the shaping tool 23 that the sleeve is in contact in the area J of the receiving mandrel 21. As already mentioned, the radius E of the bottom 3 is here also reduced by compression. Thanks to the elastic resetting forces of the paper material, the result after withdrawal of the shaping tool 23 is the state shown in Figure 10, where the radius B has slightly increased again. Despite this elastic resilience, the feature in accordance with the invention that the radius B is at most exactly the same size as the radius E, and as already described above, is retained.

For shaping the skirt 5 with the widened portion 10, an outer ring and inner jaws 32 are provided in Figure 10. An inner face of the outer ring 31 facing the sleeve 2 is positioned outwards and has the angle which the skirt 5 is to take in the end state.

Opposite the outer ring, several inner jaws 32 are provided, the illustration in Figure 10 showing only one inner jaw. The inner jaws 32 can be moved outwards in the illustration in Figure 10, in the direction of the outer ring 31, and thereby press the curl 30' against the wall 4 of the bottom 3 and finally against the inner surface of the outer ring 31.

For example, either the jaws 32 only or the ring 31 only or both the inner jaws 32 and the outer ring 31 can be heated, so that the three contacting material layers are bonded to one another at the same time as the bowl-like wall 4 is widened, thereby forming the skirt 5. A radially outward facing surface of the inner jaw 32 is arranged parallel to the inside surface of the outer ring 31 and also has the angle under which the skirt 5 is to be arranged in the final state.

The inner jaws 32 are for example part of a mandrel, not shown, and can be moved radially outwards by displacing a central part, also not shown in Figure 10. The outer ring 31 can be designed as a solid ring or for example also as an openable ring to facilitate sliding it down from the finally sealed skirt 5. Instead of the inner jaws 32, it is for example

also possible to provide an all-round roller that exerts a force, oriented radially outwards in the direction of the inner surface of the outer ring 31, on the curl 30' in order to form the skirt 5. During shaping of the skirt 5, the cup remains on the receiving mandrel 21. After formation of the skirt 5, the inner cup 1 is completed and can be removed from the receiving mandrel 21.

An outer sleeve 13 is then – see Figures 4 and 5 – slid onto the inner cup 1 completed in this way. This is done in such a way that the outer sleeve 13 is received inside a ring-like outer tool, and a pilot mandrel with a suction head is pushed through the tapered end of the outer sleeve 13. The inner cup 1 is slid into the outer sleeve 13. The suction head on the inner cup 1 engages from below with the bottom 3, fixes it and pulls the inner cup into the tapering outer sleeve 13 until the state shown in Figures 4 and 5 is reached.

To manufacture the outer sleeve 13, a flat blank having the form of a segment from a circular ring is wound onto the mandrel and joined to form a frustum-shaped tube. In the area of the end tapered at the bottom, a curl 33 is then pre-shaped in accordance with Figure 11. This curl 33 is a pre-stage of the curl 20 as shown in Figures 4 and 5. To manufacture the cup 1 shown in Figure 5, the curl 33 is then pressed flat until the form of curl shown in Figure 12 is obtained. It can be discerned that the lower rim 19 of the outer sleeve 13 formed by the curl 16 is slightly drawn in and therefore has a greater conicity at the lower end, as already set forth. In the illustration in Figure 12, knurling or grooving 34 is indicated on the inside of the curl 20. Knurling or grooving 34 of this type on the inside of the curl 20 can be provided to achieve a greater elasticity when sliding the outer sleeve 13 onto the inner cup 1. Furthermore, the area 17 of the curl 20 running parallel to the outer sleeve 13 can be seen in Figure 12. To manufacture a curl 16 in accordance with Figure 4 from the preliminary stage 33 shown in Figure 11, only the area 17 is positioned parallel to the outer sleeve 13, with further flat-pressing not being needed.

When shaping the curl 16 in accordance with Figure 12, the inner radius P of the outer sleeve 13 is shaped smaller than the radius D of the widened portion 10. This can already been seen in the illustration of Figures 4 and 5. When sliding on the outer sleeve 13, the end of the outer sleeve 13 with the curl 16 must therefore widen slightly to be slid over the

skirt 5. This widened portion is facilitated by the knurling or grooving 34. In addition, the longitudinal seam of the outer sleeve 13 can be non-glued or non-sealed in the area of the curl 16. This facilitates a certain opening of the outer sleeve 13 in the area of the curl 16, so that the outer sleeve 13 contracts again after being slid over the skirt 5, such that the curl 16 in the position shown in Figure 5 is securely in contact with the outside of the skirt 5 and rests thereon.

It can furthermore be stated that a radius G at the upper end 35 of the parallel area 17 is greater than the outer radius D of the skirt 5. This can also be gathered from Figure 5. Since the inner diameter of the outer sleeve 13 at the upper edge 35 of the curl 16 is thus larger than the outer diameter of the widened portion 10, this upper edge 35 of the curl 16 cannot catch on the widened portion 10 during sliding onto the skirt 5. Instead, the skirt 5 runs onto the slope formed by the area 17 and during further sliding on of the outer sleeve 13 it is widened, slips over the area with the largest radius D of the skirt 5, and then takes the position shown in Figure 5. It can be seen that the outer sleeve 13 is then also held by the internal tension in the outer sleeve 13 on the inner cup 1, since removal of the outer sleeve 13 requires the latter to be again pulled over the conically widening skirt 5.

It should also be expressly pointed out that the different embodiments of the outer sleeve 13 and other design means of the cup 1 such as the shoulder 9 or the shoulder 18 can be combined with one another in any way as required, and are not restricted to the variants illustrated. It must also be pointed out that the illustrations are not to scale. For reasons of better clarity, in particular the inclination angle A of the sleeve 2 and the size differences in the radii of the sleeve 2 and the widened portion 10 are shown in enlarged form.

Claims

1. Cup (1) made of a paper material having a fillable interior (6) formed by a conical sleeve (2) and a bottom (3), the bottom (3) being fastened to the sleeve (2) at the lower end of the interior (6) with a skirt (5) in a substantially liquid-tight manner, where a shoulder for holding an identical cup (1') during stacking of several cups is arranged on the sleeve (2) limiting the interior (6), characterized in that the radius (B) of the sleeve (2) – seen with respect to the central axis (8) of the cup (1) – underneath the shoulder (9) is at most just as large as the radius (E) of the bottom (3).

2. Cup according to Claim 1, characterized in that the radius (B) underneath the shoulder (9) is smaller than the radius (E) of the sleeve (2) at the level of the bottom (3).

3. Cup according to Claim 1 or 2, characterized in that underneath the shoulder (9) a vertical portion (F) of the sleeve (2) exists in which the angle (A) of the sleeve (2) relative to the central axis (8) is substantially smaller than the angle (A) of the conical sleeve (2) above the shoulder (9).

4. Cup according to one of Claims 1 to 3, characterized in that underneath the shoulder (9) a vertical portion (F) of the sleeve (2) exists in which the angle (A) of the sleeve (2) is less than half of the angle (A) of the conical sleeve (2) above the shoulder (9).

5. Cup according to one of Claims 1 to 4, characterized in that underneath the shoulder (9) a vertical portion (F) of the sleeve (2) exists in which the angle (A) of the sleeve (2) is negative.

6. Cup according to one of Claims 1 to 5, characterized in that underneath the shoulder (9) a vertical portion (F) of the sleeve (2) exists in which the sleeve (2) runs substantially parallel to the central axis (8).

7. Cup according to one of Claims 1 to 6, characterized in that underneath the shoulder (9) a vertical portion (F) of the sleeve (2) exists in which the angle (A) of the sleeve (2) differs from the angle (A) of the conical sleeve (2) above the shoulder (9) and which extends from the shoulder (9) to the bottom (3).

8. Cup according to one of Claims 1 to 7, characterized in that underneath the shoulder (9) a vertical portion (F) of the sleeve (2) exists in which ribs (27) running parallel to the central axis (8) are arranged.

9. Cup according to one of Claims 1 to 8, characterized in that the radius (B) of the sleeve (2) underneath the shoulder (9) is more than 0.5 mm, in particular more than 1 mm, smaller than the radius (C) of the sleeve (2) above the shoulder (9).

10. Cup according to one of Claims 1 to 9, characterized in that the sleeve (2) limiting the interior (6) between the shoulder (9) and the bottom (3) is substantially cylindrical.

11. Cup according to one of Claims 1 to 10, characterized in that the sleeve (2) and/or the bottom (3) in the area of the skirt (5) and/or the skirt (5) itself has at least in an area along the circumference an outward-projecting widened portion (10 and that a lower rim (11) of the widened portion (10) forms a standing surface for the cup (1).

12. Cup according to Claim 11, characterized in that the outer radius (D) of the widened portion (10) is greater than the outer radius (E') of the sleeve (2) at the level of the bottom (3).

13. Cup according to one of Claims 1 to 12, characterized in that the cup (1) has an outer sleeve (13).

14. Cup according to Claim 13, characterized in that the outer contour of the outer sleeve (13) is within a parallel (12) to the sleeve (2) limiting the interior (6) that is applied to the widened portion (10) of the skirt (5).

15. Cup according to Claim 13 or 14, characterized in that a conical outer sleeve (13) has in a rim area an inward-facing curl (16) that has an area (17) running substantially parallel to the outer sleeve (13).

16. Method for manufacture of a cup made of a paper material comprising a conical sleeve and a bottom fastened in a liquid-tight manner by a skirt in the area of the smaller circumference of the sleeve, where a shoulder is shaped into the sleeve for holding an identical cup during stacking of several cups, characterized in that to shape the shoulder an area of the sleeve is shaped to give a radius – seen with respect to the central axis of the cup – that is smaller than the radius of the sleeve in the completed cup at the level of the bottom.

17. Method according to Claim 16, characterized in that in a vertical portion of the sleeve is shaped to give a constant radius.

18. Method according to Claim 16 or 17, characterized in that the shoulder is shaped before the bottom is connected substantially in liquid-tight manner to the sleeve.

19. Method according to one of Claims 16 to 18, characterized in that the bottom is, during shaping of the shoulder, already inside the sleeve shaped into a tube.

20. Method according to one of Claims 16 to 19, characterized in that the outer radius of the bottom is reduced in the elastic area by compression during shaping of the shoulder.

21. Method according to one of Claims 16 to 20, characterized in that the shoulder is formed by an axial displacement of a shaping tool in the direction of the greater circumference of the conical sleeve.

22. Method according to one of Claims 16 to 21, characterized in that ribs running parallel to the central axis are shaped during forming of the shoulder in the sleeve.

23. Method according to one of Claims 16 to 22, characterized in that in a method step together with shaping of the shoulder the sleeve is curled around an area of the bottom.

24. Method according to one of Claims 16 to 23, characterized in that in a method step subsequent to the shaping of the shoulder the bottom is connected in substantially liquid-tight manner to the sleeve while forming a skirt.

25. Method according to one of Claims 16 to 24, characterized in that during formation of the skirt the sleeve and/or the bottom in the area of the skirt and/or the skirt itself is widened outwards at least in an area along the circumference such that a lower rim of the widened portion forms a standing surface for the cup.

26. Method according to one of Claims 16 to 25, characterized in that a vertical portion of the sleeve is shaped to be substantially cylindrical for formation of the shoulder.

27. Method according to one of Claims 16 to 26, characterized in that an outer sleeve is slid onto the conical sleeve limiting the interior and fixed.

28. Method according to Claim 27, characterized in that after shaping of a widened skirt an outer sleeve pre-shaped in a tube form is slid in the axial direction onto the conical sleeve of the inner cup limiting the interior.

29. Method according to Claim 28, characterized in that the outer sleeve pre-shaped in a tube form has – when slid onto the conical sleeve of the inner cup limiting the

interior – at least in one area a radius smaller than the outer radius of the skirt at the lower rim of the widened portion.

30. Device for manufacture of a cup made of a paper material with a receiving mandrel for a conical sleeve and a bottom of the cup, the receiving mandrel having a step for forming a shoulder in the sleeve, characterized in that an area (J) in which the radius (K) of the receiving mandrel (21) – when seen relative to the central axis (8) of the receiving mandrel (21) – is smaller than the outer radius (E) of the cup bottom (3) adjoins the step (22) of the receiving mandrel (21).

31. Device according to Claim 30, characterized in that a vertical portion (J) of the receiving mandrel (21) has a constant radius (K).

32. Device according to Claim 30 or 31, characterized in that the step (22) as an angle (A) from 40° to 70°, in particular from 50° to 60°, relative to the central axis (8) of the receiving mandrel (21).

33. Device according to one of Claims 30 to 32, characterized in that the radius of the receiving mandrel (21) changes by more than 0.5 mm, in particular by more than 1 mm, at the step (22).

34. Device according to one of Claims 30 to 33, characterized in that a cylindrical area (J) of the receiving mandrel (21), in which the radius (K) of the receiving mandrel is less than the outer radius (E) of the bottom (3) adjoins the step (22).

35. Device according to one of Claims 30 to 34, characterized in that the step (22) has the shape of a circumferential surface of a frustum.

36. Device according to one of Claims 30 to 35, characterized in that the device has a shaping tool (23) interacting with the receiving mandrel (21) for shaping the shoulder (9) and movable along the central axis (8) of the receiving mandrel (21).

37. Device according to one of Claims 30 to 36, characterized in that the shaping tool (23) has a means (29) for shaping a curl (30) of the sleeve (2) enclosing the bottom (3).

38. Device according to one of Claims 30 to 37, characterized in that the shaping tool (23) is designed as a ring enclosing the sleeve (2).

39. Device according to Claim 38, characterized in that the ring (23) has an inner radius (M) smaller than the outer radius (E) of the cup bottom (3).

40. Device according to one of Claims 30 to 39, characterized in that the shaping tool (23) has recesses (26) running parallel to the central axis (8) for shaping ribs (27).

Fig. 1

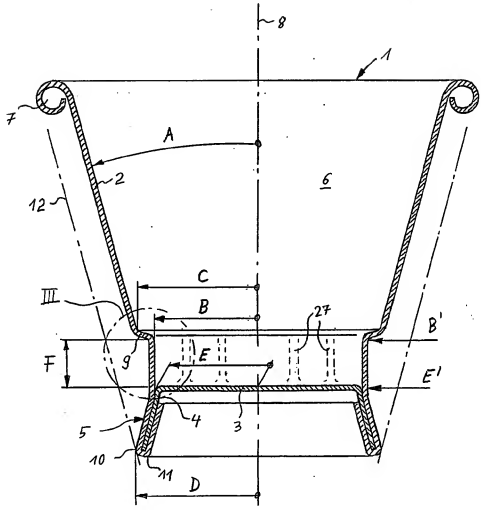

Fig. 2

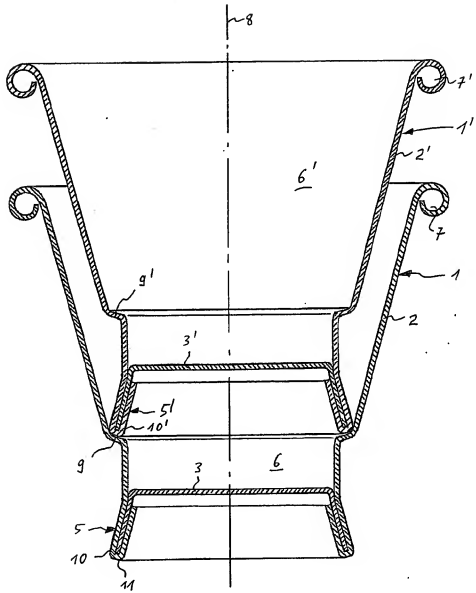

Fig. 3A

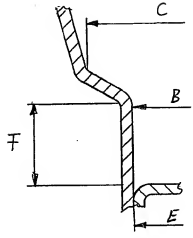

Fig. 3B

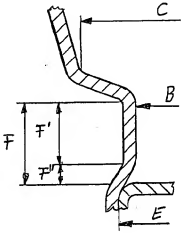

Fig. 3C

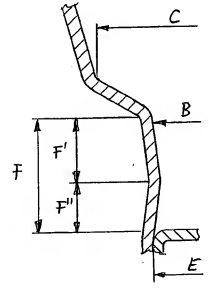

Fig. 3D

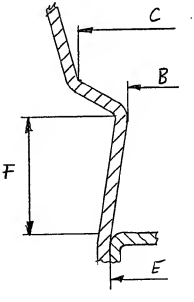

Fig. 5

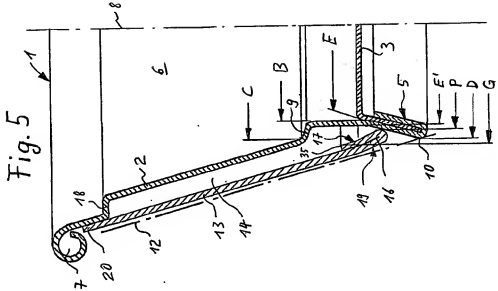
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Fig. 4

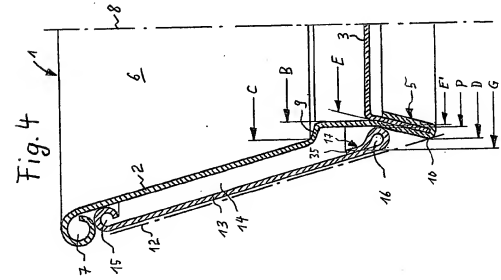
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Fig. 5A

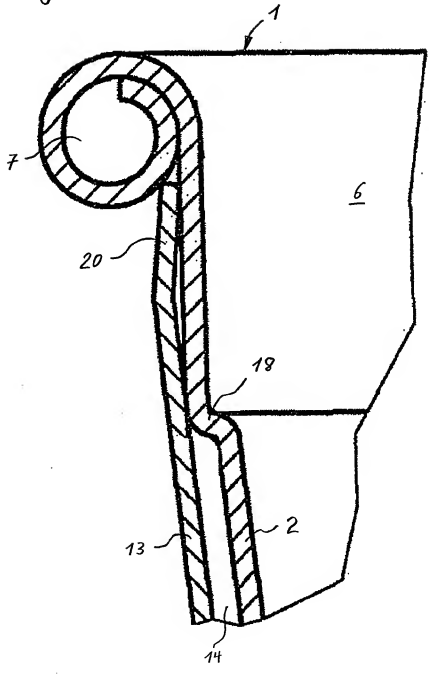

Fig. 6

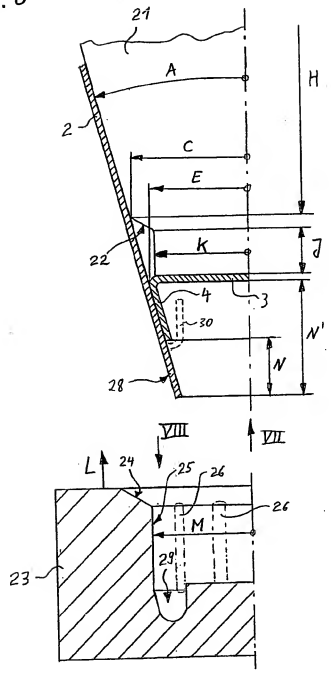

Fig. 7A

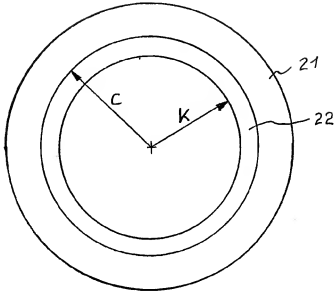

Fig. 7B

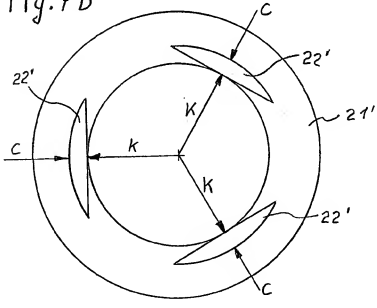

Fig. 8

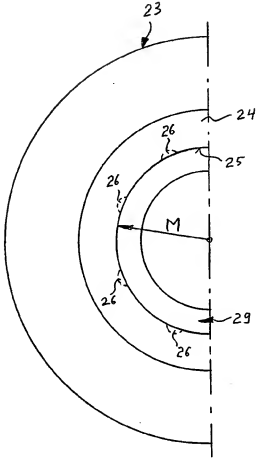

Fig. 9

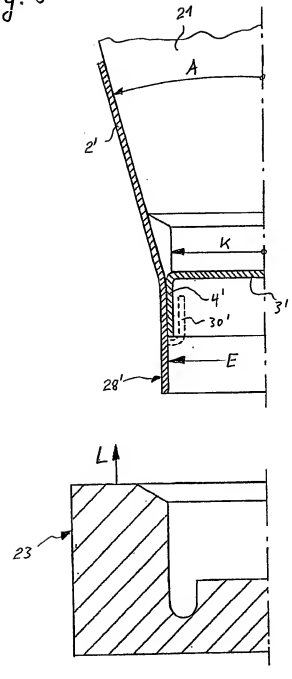

Fig. 10

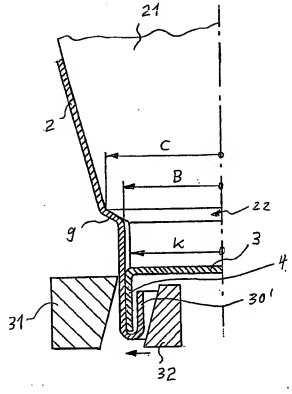

Fig. 11

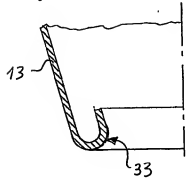

Fig. 12